COOKING FAT PRODUCT WITH IMPROVED SPATTERING BEHAVIOUR

TECHNICAL FIELD

The invention relates to a method for improving the spattering behaviour of a cooking fat product when shallow frying food. Cooking fat products according to the present specification comprise cooking fats which do not contain a substantial amount of dispersed aqueous phase

BACKGROUND AND PRIOR ART

The use of a cooking fat product for frying often is accompanied by spattering. Spattering occurs when water or a water containing food product such as meat is brought in contact with a heated frying fat.

Spattering behaviour of a cooking fat product which contains no substantial amount of dispersed water, particularly of a cooking oil, is measured generally by determining its spattering value SV_{oil} according to the corresponding protocol as specified in the examples section.

Common anti-spattering agents for use in cooking fat products comprise emulsifiers in a broad sense e.g. lecithin, hydrolysed lecithin, esters of citric acid and alcohols (Citrem™) and cooking salt. Only lecithin and cooking salt are natural, but the effect of lecithin on spattering is limited. Lecithin, moreover, has the disadvantage that it may decompose at high frying temperatures and causes bad smell, discoloration and

foaming. Cooking salt (sodium chloride) has to be added in a substantial amount for showing an effect.

US 4,399,165 discloses an edible oil composition suitable for frying applications, comprising a liquid oil, an emulsifier, a browning substance and an effective amount of a stabilising material. Suitable emulsifiers mentioned in this document include monoglycerides, lecithins, citric acid esters, tartaric acid esters, lactic acid esters and mixtures thereof.
The examples in US 4,399,165 show that products comprising soy lecithin exhibit only limited spattering when beef was fried.

Patents EP 477825 and EP 771531 disclose the use of citric acid esters for improving spattering behaviour.
US 3,946,122 and US 5,436,021 disclose water and oil emulsions comprising a citric acid ester of a mono- or diglyceride of fatty acids for improving spattering behaviour.
WO 01/84945 mentions the use of a citric ester of a partial fatty acid glyceride for improving spattering behaviour.

A relatively high salt content is typical for most prior art cooking oils which show an improved spattering behaviour. EP 775444 discloses a pourable fat containing composition comprising herbs, spices, nuts or seeds and 1-10 wt.% of salt.

The present invention provides a method for improving the spattering behaviour of a cooking fat product using ingredients which are cheap, natural and highly effective.

SUMMARY OF THE INVENTION

The invented method consists in the use of powdered vegetable matter for improving spattering behaviour as defined in claim 1.

DETAILS OF THE INVENTION

We have found a method for improving the spattering behaviour of a cooking fat product containing 0 - 5 wt.% of a dispersed aqueous phase which comprises the steps

a. selecting a cooking fat product containing 0 - 5 wt.% of a dispersed aqueous phase,
b. selecting fat insoluble vegetable matter having a consistency which allows milling to a powder,
c. milling the vegetable matter to a powder having an average particle size $d_{4,3}$ selected from the range 1 - 2000 µm,
d. admixing the resulting powder to the cooking fat product in an amount of 0.1 - 25 wt.% on product and getting it evenly dispersed throughout the product.

The cooking fat product usually is an oil. Any cooking oil which is commonly used for shallow frying may be selected such as olive oil, soybean oil, rapeseed oil, palm oil, sunflower oil, corn oil, safflower oil, cotton seed oil, palmkernel oil, coconut oil, linseed oil, lauric oils, butter or fractions thereof and mixtures of these oils. The cooking fat product also may be a fat which is solid at ambient temperature, but which liquefies in the heated frying pan.

The cooking fat product optionally comprises a small amount, usually 0.5-5 wt.%, of a structuring fat which serves to impart dispersion stability to the final product. Structuring fats are well known from e.g. liquid and plastic margarines and comprise e.g. hydrogenated high erucic rapeseed oil, which is particularly preferred because it is able to keep particles stably dispersed in liquid oil. Other suitable structuring fats comprise, for example, hydrogenated fish oil, hydrogenated ground nut oil, hydrogenated sunflower oil and also solid non-hydrogenated fats, and mixtures of those fats.

It may appear to be expedient to disperse the powdered material into the cooking fat product as a slurry with water. The amount of water should not exceed such amount that the final product contains more than 5 wt.% of dispersed aqueous phase.
If the cooking fat product has a solid consistency, it should be liquefied before mixing with the powder.

The vegetable matter selected for milling consists of one or more substances which are selected preferably from the groups consisting of fruits (e.g. olives), nuts (e.g. almond, walnut, cashew nut, ground nut, pine tree nut), seeds (e.g. sunflower seed, linseed), beans (e.g. soybeans), kernels and pits (e.g. olive kernels) and also pectin, alginate and cellulose and, of course, mixtures of said substances. However, many more substances are effective as well, which is apparent from Table I.

The volume weighted mean diameter ($d_{4,3}$) of the powder particles, which size best approximates the modal diameter, is selected from the range 1 - 2000 μm, preferably from

the range 1 - 700 µm, more preferably from the range 1 - 100 µm and still more preferably 1 - 40 µm. For measuring volume weighted mean diameter suitably a Malvern Mastersizer S device is used following the corresponding measuring protocol.

Without wishing to be bound by theory, it is believed that the milling treatment changes the outer structure of the particulate vegetable matter such that the transformation of water into steam is controlled in such way that spattering is reduced because explosive outbursts of steam are prevented or at least reduced.
For miling the selected soft to medium-hard and fibrous vegetable matter a Retsch ZM100 ultracentrifugal mill is especially suitable. Generally, a sieve with an aperture size of 0.2 mm is suitable.

The vegetable matter selected for milling is said to be fat insoluble. This means that at least 50 wt.%, preferably at least 65 wt.%, more preferably at least 80 wt.%, still more preferably at least 95 wt.% of the vegetable matter is fat insoluble.
When the fat amount of the selected vegetable matter causes milling difficulties, the milling step is preceded by a defatting treatment. Common extraction with solvent, e.g. hexane or liquified carbon dioxide, preferably after coarsely crushing or milling the vegetable matter, gives a satisfactory result. Defatting may appear to be less necessary for substances having a low fat content. Nevertheless fat extraction may contribute to improve the eventual spattering behaviour of the obtained cooking fat product.

Besides defatting also drying is an optional pre-treatment for making the selected vegetable matter more suitable as an ingredient for the invention. Olive particles are used preferably after freeze drying.

Optionally, the cooking fat product comprises other ingredients such as lecithin, a colouring agent, one or more flavour components or salt. Lecithin, when present, is added up to 0.5 wt.%. For reasons mentioned above the cooking fat product used fo the present invention preferably is substantially free from lecithin, hydrolysed lecithin and cooking salt. Keeping the salt content low is preferred from a nutritional point of view.

The powder resulting from the milling is dispersed into the oil in an amount which is selected from the range 0.1 - 25 wt.%, preferably 0.1 - 10 wt.%, more preferably 0.1 - 5 wt.%, still more preferably 0.1 - 1.0 wt.%.

According to a particular embodiment the higher powder concentrations are used preferably in a cooking fat product which is solid at ambient temperatures. Such product is used preferably in a small amount in combination with a common cooking oil. When heated in a frying pan the fat melts, blends with the cooking oil and so exhibits its anti-spattering quality. Fats with a high powder concentration are offered for sale preferably in portion pack format and so serve as easily applicable anti-spattering kitchen aids.

Particularly preferred for use in the present invention is the powder obtained by milling the kernels of olives and seeds or beans, preferably sunflower seeds, linseed and

soybeans, optionally milled after a defatting treatment. For unknown reasons these powders exhibit extraordinarily high SV_{oil} values.

Another group of substances which are preferably used for the invented method consists of cellulose, pectin and alginate.

Cooking fat products resulting from the invention show a strongly improved spattering behaviour characterised by a SV_{oil} value being at least 4. For some ooking fat products SV_{oil} values exceeding 7 and even 8 are attained, which is a quality not yet shown for a cooking oil.

The concentrations mentioned in this specification are weight concentrations on total product unless indicated otherwise.

General method for determining spattering value

The spattering behaviour of cooking products according to the invention is evaluated after storage of the prepared product for at least 1 day at room temperature. Before testing, liquid samples are well shaken to make them homogeneous.

For assessment of spattering values (SV_{oil}) 21 g of test sample (0.5 wt.% of powder dispersed in refined sunflower oil) is heated in a shallow glass dish on an electric plate set at about 205°C.
Spattering is assessed by pouring a small amount, 0.5 ml of water into the heated fat product. The fat droplets

spattering out of the dish are captured on a sheet of paper fixed above the dish at a distance of 25 cm.
The speckled image of the obtained test paper is compared with a standard set of reference sheets numbered 0, 2, 4, 6, 8, 10. The number of the best resembling sheet is recorded as actual spattering value. Ten indicates no spattering at all and zero indicates very heavy spattering. The other scoring figures correspond with spattering behaviour as follows:

SV_{oil} score	*Spattering Behaviour*
10	excellent, no spattering
8	good
6	just good
4	poor
2	heavy spattering
0	very heavy spattering

SV_{oil} scores of plain vegetable oils usually are 0 and do not exceed 2.

The mean size of the particles resulting from the milling process is critical for their spattering reducing quality. For size comparison of various samples the volume weighted mean diameter ($d_{4,3}$) is measured. This diameter is close to the modal diameter. The volume weighted mean diameter suitably is measured in a Malvern Mastersizer S, a gauge based on laser light scattering. The apparatus is filled with the refined sunflower oil. Powdered material is added until 20% obscuration (80% of original maximal signal) is reached (about 0.5 g added), whereafter actual measurement is started. For calculation of the value of $d_{4,3}$ the Mie theory is used with the following parameters/values:

Solvent refractive index 1.4694; Particle refractive index, Real part: 1.5300; Particle refractive index, Imaginary part: 0.1.

The following examples illustrate the invention.

EXAMPLES

Fully refined (nbd) sunflower oil was selected as cooking oil. Vegetable matter as exemplified in Table I was milled in a Retsch ZM100 ultra centrifugal mill, which mill is especially suited for grinding soft to medium-hard and fibrous materials.

In general the aperture size of the mill's sieve was 0.2 mm. Where indicated, a different sieve size was applied. After milling the powder was added to the oil in an amount of 0.5 wt.%.
Where indicated, the vegetable matter was defatted prior to milling by a standard extraction process in a Soxhlet device using hexane as solvent. Before extraction the vegetable matter was coarsely crushed. Residue solvent was removed in a rotary evaporator.

Particularly with olive kernels it can be seen, that the SV_{oil} value improves when the particle size ($d_{4,3}$) of the used powder decreases.

TABLE I

Vegetable Matter	Sieve size (mm) (2)	(1)	Powder size (µm) (3)	SV_{oil}
Olive kernels	0.08		72 (58)	7
Olive kernels	0.2		94 (74)	5
Olive kernels	1		332 (90)	2-2.5

Vegetable Matter	Sieve size (mm) (2)	(1)	Powder size (µm) (3)	SV_{oil}
Rice	0.2		100	7.5
Lasagna leaves	0.2		56	6.5
Nutmeg powder	n.d.		164	6.5-7
Thyme powder	n.d.		142	6.5-7
Brown beans	0.2		64 (43)	6.5-7
Green beans	0.2		96 (48)	6-6.5
Soybeans	n.d.		56	8
Linseed	0.2	x	66	8
Pine tree nuts	0.2	x	38	7.5
Sunflower seed	0.2	x	32	8.5
Sunflower seed	1	x	82	8.5
Abricot nuts	0.2		68	6
Tapioca starch	n.d.		31	7-7.5
Cellulose	n.d.		203	6-6.5
Comparison				
No addition				1

(1) Prior hexane extraction? x: yes

(2) Aperture size of the mill's sieve;
n.d. : non determined

(3) Volume weighted mean diameter ($d_{4,3}$) of the powder, analysed with a Malvern Mastersizer S device